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CIRC Model Assisted by *Flipping book* Media on Vibration, Waves, and Sound Material to Improve Science Learning Outcomes in Junior High Schools

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Abstract: 21st-century learning requires students to be equipped to process and use the information activities such as applying the *CIRC* learning model assisted by *flipping book* media. This study aims to determine the application of the *CIRC* learning model assisted by *flipping book* media to improve science learning outcomes. The research design used was the *pretest-posttest* control group. The population of this study was eighth-grade students at SMPN 1 and SMPN 2 Simeulue Timur because, based on data and observations, science learning outcomes were still low and taught using a teacher-centered model. The sample was determined using the purposing technique Sampling, which resulted in 108 students divided into two classes. The results showed that the *N-Gain* value of the experimental class was 56.96 and the control class was 28,04 and $t_{hit} > t_{tab}$ (9.42 > 1.98), indicating differences in the increase in cognitive learning outcomes of the two types of classes.

Keywords: *CIRC*; *Flipping Book*; Learning Outcomes; Vibration; Science

Introduction

Today's education is always experiencing renewal synonymous with innovation and technology that is developing very rapidly so that it has influences from various aspects of life, including the teaching and learning process. Therefore it is important to always carry out learning innovations in order to solve problems in the world of education. The implementation of the 2013 curriculum is expected to include innovation according to the learning needs of the 21st century (Makhrus, 2019). One of the efforts to achieve this goal is to increase mastery of the material being taught with appropriate learning models and media in accordance with the demands of the curriculum. Data on the results of the National Examination (known with UN) for SMP/MTs students from 2017 to 2019 show that the average science score at SMPN 1 and SMPN 2 Simeulue Timur is below the number 55 which is the standard score that has been set (Kurikulum, 2019) and students should able to reach it.

Furthermore, based on these values, it is also known that vibration, wave and sound material is one of the natural science materials whose average National Examination score is relatively low with the percentage achieved, namely 24.77 for SMPN 1 Simeulue Timur, while for SMPN 2 Simeulue Timur with a percentage of 19.86 (Puspendik, 2019). It indicates that the learning process has not been maximized, where 21st-century learning requires students to be equipped with the ability to process and use information appropriately and effectively, where education currently needs to be more proactive in focusing attention on the learning process of students (Salwan & Rahmatan, 2017), because learning conditions greatly affect the activity and learning outcomes of students (Febriyanti & Mayarni, 2022), and

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students' motivation to play an active role in the learning process will be seen in their learning outcomes (Jannah, 2021; Mustika et al., 2018). Meanwhile, based on the results of observations that have been made, it is known that students study with a one-way learning model and do not actively seek other additional information such as by reading, one of which is because reading material in printed books alone does not attract students' attention.

One learning model that can be used to improve the quality of student learning that has a direct impact on learning outcomes, as well as making learning able to generate student motivation and activity, as well as developing a cooperative attitude is to apply the cooperative learning model (Zubaedi, 2010). Cooperative learning models integrated as a whole are like the Cooperative Integrated Reading and Composition (*CIRC*) model, where students are assigned to read a passage seriously and can understand and retell the contents of the reading as a form that students have understood the meaning of the reading. Besides having a straightforward syntax, the *CIRC* learning model has several advantages. The advantages are: (1) the teacher's dominance in learning is reduced; (2) students are motivated by results carefully because they work in groups; (3) students can understand the meaning of the questions and check each other's work; (5) helping weak students (Shoimin, 2014). In addition, the *CIRC* learning model can provide an experience for students, hone ways of thinking, and broaden students' insights because after reading, students are taught students to be able to write down what they have understood from the reading. It can create an engaging learning atmosphere.

However, knowledge of vibration, waves, and sound matter will be increasingly abstract and difficult to understand if it is only conveyed through verbal language. This kind of thing can lead to misperceptions of students, so learning objectives are not achieved. Therefore, for students' experiences to become more concrete and the messages conveyed can achieve the goals and objectives to be achieved. It is accompanied by learning media that can provide demonstrations or actual examples of this material, especially in life (Wiyono et al., 2016). One of the software media that can be used is *flipping book* media. Flipbook media has many advantages because it can contain interesting images, audio, video, and flip effects (Setianingrum et al., 2022). Through *flipping books*, students can also access material as often as needed so they can repeat material they have yet to understand. Therefore, learning models such as *CIRC* are considered appropriate if you want to create a learning atmosphere that is no longer one-way and clarify abstract material using media such as *flipping books*.

Several studies have been conducted on the application of the cooperative model and the use of *flipping book* media. They have had a positive effect on learning, including showing that the application of the cooperative model makes students active in the learning process and learning outcomes increase (Altun, 2015; Ernawita & Safitri, 2018; Ghasemi & Baradaran, 2018). Furthermore, other research using *flipping books*, or developing the use of this type of media, concludes that students have a positive perception of media that is integrated with this technology and is also able to increase student independence and learning outcomes (Roemintoyo & Budiarto, 2021; Linda et al., 2021). However, the *CIRC* model generally applied to language subjects, and understanding other concepts in this study applied to natural science subjects. Based on this explanation, this study aims to apply the *CIRC* cooperative model assisted by *flipping book* media on vibration, waves, and sound material with the hope that students can know and understand the concept of natural science so that they can improve student learning outcomes.

Method

This research was implemented using a quasi-experimental method with a *pre-test-post-test* control group design. The *CIRC* model assisted by *flipping book* media was applied to the experimental class, while the control class used conventional learning methods. The two types of classes will be given a *pre-test* and *post-test*, which are expected to measure the increase in student learning outcomes in both classes before and after getting learning. The population in the study were all Grade VIII students at SMPN 1 and SMPN 2 Simeulue Timur in the 2021/2022 academic year, with a total of 7 classes. The sample was determined using the *Simple RandomSampling* technique because, based on the pre-test results, members of the population have the same value characteristics. Based on these results, the research sample total of 108 students. The stages of conducting the research can be seen in the following chart.

Flipping book media, observation sheets, and questionnaires on student responses as tools and test instruments in the form of 15 multiple-choice questions. The increase in students' cognitive learning outcomes can be known by measuring mastery of concepts before and after learning which is calculated based on the *N-Gain* index and comparing the averages of the two classes with the T-test. This value is calculated using the *Statistical Package for the Social Science* (*SPSS*) application with categories according to Hake (1999): data review techniques with normality tests, homogeneity, and assumption tests.

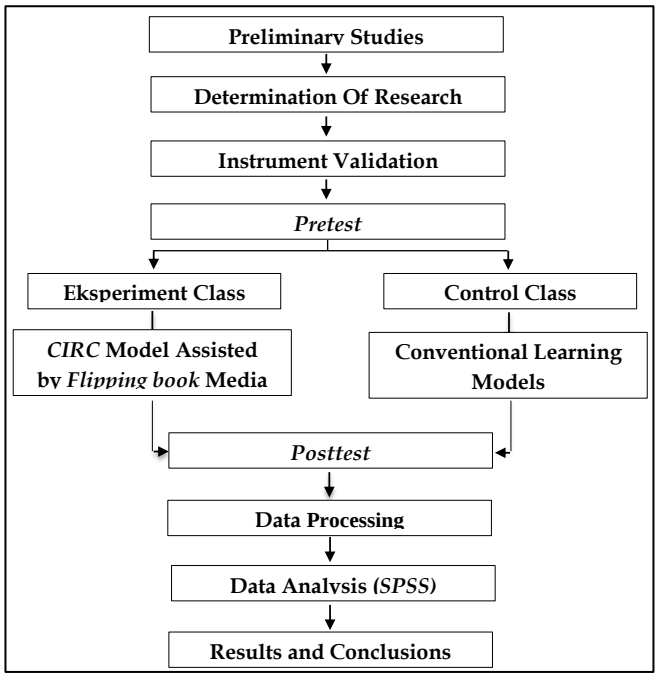

Figure 1. Chart of stages of research implementation

Tabel 1. Criteria for *the N-Gain value*

N-Gain Value	Category
(g) > 0.7	Tall
0,7 > (g)>0.3	Currently
(g) > 0.3	Low

(Hake, 1999)

The data normality test aims to determine whether the resulting data is typically distributed or not. The test uses the *Kolmogorov-Smirnov Test*. Likewise, the homogeneity test was carried out to determine whether the resulting data was homogeneous. The test was carried out by identifying data from the experimental and control groups. This test used the *Levene Test* and, finally, the hypothesis test or the two average tests. Test all three with the help of the *SPSS* application with a significant level (α) = 0.05. A significant value is obtained if it is more than 0.05, then the data is usually distributed, and the data is the same or homogeneous; otherwise, if it is less than 0.05, then the data is not normally distributed or homogeneous. Whereas in the hypothesis test with the *Independent t-test*, if $t_{count} > t_{table}$, there is a difference between the experimental and control classes and vice versa.

Result and Discussion

Tools such as lesson plan, student worksheet, and *flipping book* media were validated, and results were obtained with sequential averages of 96.8, 98.9, and 87.0%, all three of which fell into the Very Good category (Riduwan & Sunarto, 2015). While the instrument questions, after being tested for validity up to the deceptive index, 15 items can be used in pretest and posttest assessments with category C1 to C4 levels regarding vibration, waves, and sound material, which are part of the science subject matter. Furthermore, to see the improvement of the two classes, namely the experimental class that applies the *CIRC* learning model assisted by *flipping book* media and the control class with the conventional model using the *N-Gain* test, the resulting data can be seen in the following Figure 2.

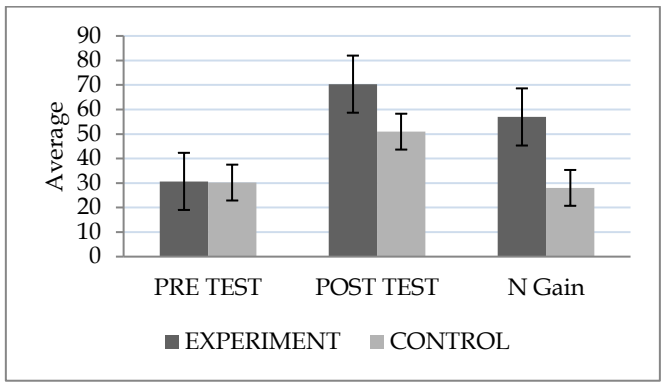

Figure 2. The average value of the experimental class and the control class

Based on the picture above, it can be seen that students' initial (pretest) abilities on vibration, waves, and sound have an average score that is almost the same, but the post-test scores have increased. However, in the experimental class, the improvement was better than in the control class. It was also seen in the *N-Gain* values in both classes. In the experimental class, it was 56.96, while in the control class was 28.08. Based on Hake's criteria (1999), the increase in learning outcomes in the experimental class is in the moderate category, while the increase in the control class is classified as low. The research of Ristanto, Rahayu & Mutmainah (2021) supports these results with an *N-Gain* value of 58.00 and Aprilia (2021), which means that the application of the *CIRC* model assisted by *flipping book* media is quite effective in improving student learning outcomes.

Hypothesis testing or Independent t-test was first tested on the pretest and posttest values, using SPSS. Data on hypothesis testing can be seen in Table 2.

Table 2. Hypothesis Test Results

Type	t_{test}		Test results	Conclusion
	t_{count}	t_{tabble}		
Pretest	0.261	1.982	$t_{cou} < t_{tab}$	There is no difference
Posttest	10.775		$t_{cou} > t_{tab}$	There are differences

The pretest value and the result were that the calculated t value was smaller than the t table value, thus proving that before treatment in the experimental and control classes, there was no difference in the value of the learning outcomes of the two. Unlike the case with

the value of learning outcomes after treatment or the posttest value, the calculated t value is greater than the t table value, which means that there are differences in the value of learning outcomes. Based on the results obtained, then an analysis of learning outcomes data was carried out to test hypotheses related to the application of the *CIRC* model assisted by *flipping book* media in the experimental class and compared to the control class, which did not apply the model and media.

Hypothesis testing was carried out through the *Independent t-test* on the *SPSS* application. The data used in the test were *N-Gain* values that were normally distributed, with a significant value in the experimental class of 0.198 and 0.200 in the control class. Thus the data in both classes were normally distributed because significance > 0.05. Furthermore, the homogeneity test of the *N-Gain* value of the two classes obtained a significance of 0.056. This value is greater than the significance of 0.05, so the variance of the values of the two classes can be homogeneous. Then a hypothesis test is carried out to find out whether or not the difference is significant from the average of the two classes of data testing the *N-Gain* value used to see the hypothesis test or the t-test as a whole can be seen in the following table.

Table 3. Results of the Normality Test, Homogeneity and Learning Outcomes Hypothesis Test

Class	test		N-Gains	Normality	Homogen	t_{test}		Conclusion
	Pretest	Posttest				t_{count}	t_{tabble}	
Experiment	30.68	70.34	56.96	0.19	0.056	9.42	1. 98	There are differences
Control	30.20	50.97	28.04	0.20				

Based on this table using *SPSS*, the results obtained show the value of t_{count} (9.423)> t_{table} (1.982), so it can be concluded that there is a significant difference in increasing cognitive learning outcomes of students between classes that apply the *CIRC* model assisted by *flipping book* media on vibration material, waves and sounds with classes that utilize conventional learning, or based on the provisions of the t-test hypothesis testing if t_{count}> t_{table} this means that the initial hypothesis (Ha) can be accepted. The alternative hypothesis (H0) is rejected.

Increasing the cognitive learning outcomes of students' vibrations and sound material before and after the implementation of the learning model both in the experimental class with the *CIRC* model and in the control class with the conventional model is evidence that there has been a learning process that has occurred. However, the applied learning model affects the difference in increasing learning outcomes. The two classes' improved learning outcomes in each cognitive level can be seen in Figure 3.

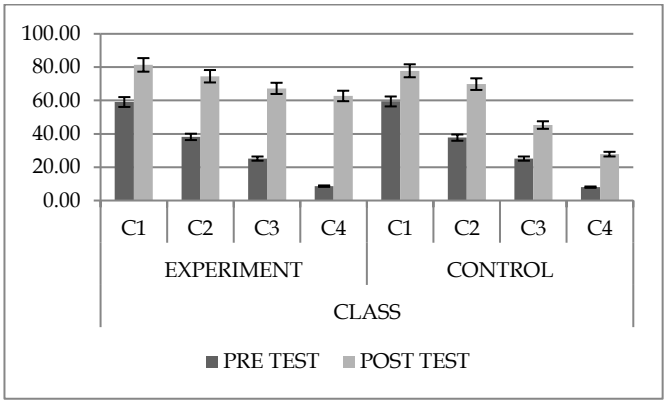

Figure 3. Learning Outcomes Based on Cognitive Level

The graph in the figure is data on cognitive learning outcomes obtained from the experimental and control classes. The increase in students' understanding of concepts can be seen from the increase in the average score on the posttest questions, with the same number of questions during the pretest, as many as 15 questions consisting of levels C1 to C4 regarding the material of wave vibrations and sound, the average value of the increase in the experimental class is 39.66, namely during the pretest 30.68 to 70.34 after applying such learning. So with these results, *CIRC* learning that is applied with the help of *flipping book* media is somewhat more effective than conventional models (Ristanto et al, 2021; Djamahar, 2019; Suharto, 2015; Hanum et al., 2014). It is because the application of *CIRC* learning with the help of *flipping book* media in the experimental class provides an opportunity for students to understand vibration, wave, and sound material, then interpret it into the worksheet answer sheet to present it in front of the class. The meaning of a concept will be able to be interpreted if it reaches a level of understanding (Ristanto 2018), meaning that reading activities in *CIRC* syntax are successful as a step of understanding if you have been able to explain or interpret it. An essential step in the *CIRC* learning model is that students in heterogeneous groups must find the essence of reading material or content and then present it (Prawitaningrum & Endarini, 2019; Djamahar, 2018; Ekawati, 2015).

Reading activities in *CIRC* syntax can improve the ability to interpret vocabulary so that understanding is formed (Durukan, 2011; Prawita & Prayitno, 2019). The increase in understanding at the C4 cognitive level in the experimental class was the result of students' analysis of the concept of the relationship between wavelength and

frequency, the relationship between period, frequency, and vibration, and analyzing sound characteristics which are part of the science material learned in class VIII of junior high school. Learning activities that involve students in finding essential facts related to vibration, wave, and sound material and rewriting them in their own words allow students to be active in learning (Gupta & Ahuja, 2014; Djamahar et al, 2019; Ristanto et al, 2018) which is a crucial feature of cooperative learning such as *CIRC*.

One of the advantages and, at the same time, the purpose of learning with cooperative models such as *CIRC* is to provide opportunities for students to interact and communicate with other students who come from different backgrounds, meaning that learning is student-centered so that students become active and produce a positive impact. Student responses and learning outcomes (Utami et al., 2021; Syukri et al., 2020). Components in the *CIRC* learning model can make teaching and learning activities more effective and creative because students together in groups can develop and exchange understandings to study a material assigned by the teacher, and group members have shared responsibility and are directly involved in learning. Facilitate students understanding of learning concepts and improve learning outcomes (Dewi et al., 2019; Yuliana et al., 2014). Furthermore, the experimental group members discussed each other's understanding of each other. So after finding the concept from the reading material, namely media flipping books, move on to the following syntax.

Media is critical in learning because it aims to convey information from sources to recipients of messages and to stimulate students to participate in learning activities. Combining the *CIRC* learning model with flipping book media can make it easier for students to understand concepts such as wave vibration and sound material being studied, to improve learning outcomes (Ambarwulan & Muliyati, 2016; Hasanah & Nulhakim, 2015). In writing syntax, the results of this understanding will be poured into the LKPD. The ability to work on the LKPD proves that students have processed the information learned, and the active learning model by implementing CIRC can make students reconstruct learning material so that the material studied will be remembered for a long time (Ristanto et al, 2018).

Rewriting the main ideas of the reading will make it easier to understand the concepts being studied. It is relevant to the research of Rahmawati & Haryadi (2016) that writing the main ideas in reading will help students to remember the outline of the reading. Therefore, it can improve cognitive learning outcomes. Reading and writing activities make students better understand the content presented during learning (Yeni & Kalsum, 2012).

The third step of *CIRC* is presenting the discussion results in front of the class. Discussion activities encourage students to express their opinions. They communicate the results of the discussion through presentations. Students who dare to express opinions will have good communication skills (Hosnan, 2014; Mueller & Oppenheimer, 2014). Communication skills are skills that students must have to dare to express their own opinions (Hayati, 2014). Communication skills are also one of the components developed in 21st-century learning (Kulsum & Nugroho, 2014). The teacher guides students to discuss and ask questions between groups and then provides reinforcement. Students then conclude the content learned. Presentation activities can train students to express their own opinions in other words discussion and presentation activities on the *CIRC* model can also improve communication skills (Dewi et al, 2019; Ika, 2018; Zivkovic, 2014).

In contrast to the control class, the initial conditions for the average *pretest* score were generally the same as the experimental class, namely 30.20, which meant that the basic knowledge of the two types of classes was the same. Still, after the lecture method learning process, the *posttest* average score only increased to 50.97, and the highest increase was only seen at C1 and C2 levels. At the same time, in the aspects of calculating and analyzing, it was much lower than the experimental class. Although all students can follow the lecture technique, the learning method makes them passive and unable to receive information or knowledge properly, especially for students with a visual learning style (Sulandari, 2020). It happens because students only learn according to the teacher's explanation, while learning concepts must involve students in the construction process in their minds (Azis & Helmi, 2019).

Therefore, by the explanation of this description, science learning, especially the material of wave and sound vibrations that apply the *CIRC* model assisted by *flipping book* media, is more effective in learning than the conventional model, namely the lecture method. Such conclusions are also drawn based on statistical calculations as previously described, and it can be seen that there are differences in increasing cognitive learning outcomes of students between classes that apply the *CIRC* Model assisted by *flipping book* media on vibration, waves, and sound material and classes that apply conventional learning.

Conclusion

Based on the discussion described, there are differences in improving students' cognitive learning outcomes between classes that apply the *CIRC* Model

assisted by *flipping book* media on vibration, waves, and sound material and classes that apply conventional learning.

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